5.2. Sensitivity Analysis

The key sensitivities that we analysed comprised:

- alternative measures of type 1 benefits described in Section 3.1.1.
- assuming that BT increases residential and business line rentals by 19% and 3% p.a. for the three years beyond 1997 (double the rate assumed in the base case) - "aggressive rebalancing";
- assuming that international call prices fall at an annual rate of 22% p.a. (double the rate assumed in the base case) - "aggressive international call price cuts";
- continuing the RPI+2 restriction on exchange line rentals beyond 1997;
- increasing and reducing the impact of equal access on the threshold discount by 50%[41];
- increasing and reducing the impact of equal access on the rate of customer migration to indirect service providers by 50%[42];
- increasing the discount rate from 6% to 10%;
- reducing the threshold discount from 5% to 2½%;
- increasing and reducing type II benefits by 50%;
- increasing and reducing the threshold discount effect and the migration rate effect by 50%.

Results from these sensitivities are shown in Table 5.2. In general the NPV of equal access remains negative under the sensitivities. The only exceptions are for Options 1 and 2 when equal access is assumed to have a greater impact in reducing the threshold discount, or a greater impact on the speed of migration to new long distance operators.

[41] This sensitivity could include additional benefits from two pre-selections.

[42] This sensitivity could also include additional benefits from two pre-selections.

Table 5.2
Summary of Sensitivity Analysis

	Discounted sums (1995 to 2010) (£millions)			
	Option 1	Option 2	Option 3	Option 4
Benefits less costs (for one pre-selection)				
Base run	-£9	-£9	-£103	-£47
Alternative measures of type I benefit	-£14 -£5	-£14 -£5	-£107 -£100	-£47 -£47
Aggressive rebalancing	-£15	-£15	-£107	-£47
Aggressive international call price cuts	-£30	-£30	-£115	-£47
RPI+2 remains after 1997	-£9	-£9	-£103	-£47
Threshold discount effect				
reduced by 50%	-£76	-£76	-£120	-£47
increased by 50%	£64	£64	-£86	-£47
Migration effect				
reduced by 50%	-£58	-£58	-£142	-£47
increased by 50%	£47	£47	-£59	-£47
Discount rate of 10%[43]	-£27	-£27	-£86	-£33
Reducing the threshold discount from 5% to 2½%[44]	-£54	-£54	-£131	-£47
Type II benefits reduced 50%	-£91	-£91	-£148	-£47
Type II benefits increased 50%	£73	£73	-£59	-£47
Threshold discount effect and migration rate effect[45]				
reduced by 50%	-£117	-£117	-£156	-£47
increased by 50%	£129	£129	-£40	-£47

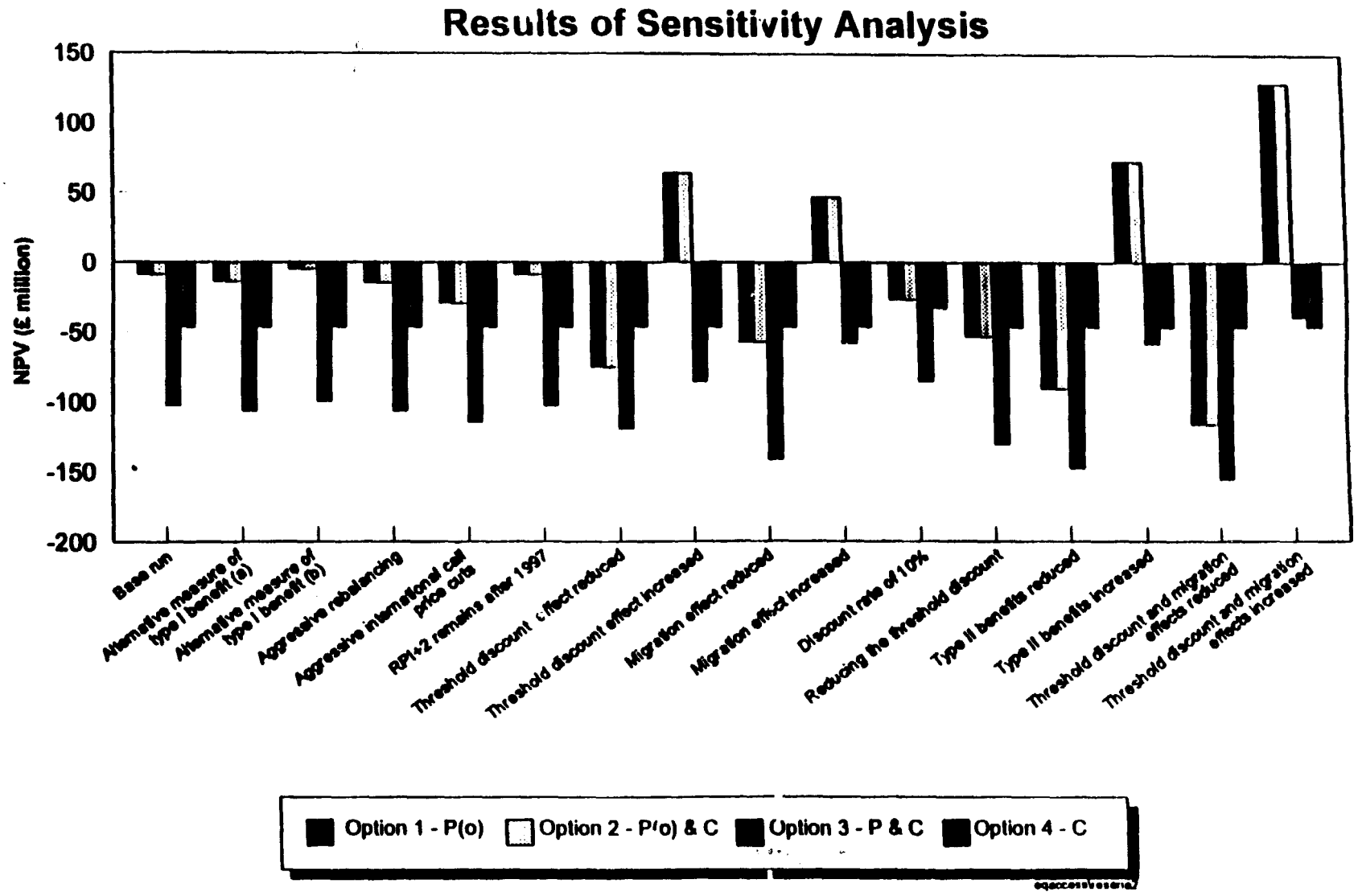
Source: NERA analysis

[43] The result of this sensitivity for Option 3 may, at first sight, appear counter-intuitive. Although increasing the discount rate has a proportionately greater impact in reducing the NPV of benefits than the NPV of costs (since the benefits occur further into the future), the absolute level of costs is greater than that of benefits, and so the net impact on the NPV of benefits less costs is positive.

[44] The impact of changes in the threshold discount can be either positive or negative, depending on the effect of re-calibration of the operator choice model that becomes necessary (see Section 3.5.2.2).

[45] The reader may note that the *absolute* impact of a 50% reduction in the threshold discount effect or the migration rate effect or the two effects combined is less than the *absolute* impact of a 50% increase (i.e. these sensitivities are not linear). This results from the non-linearity of the customer bill distribution profile.

Chart 5.1



Note: Costs and benefits have been discounted to 2010

5.3. Conclusions

The terms of reference of this cost-benefit analysis have been restricted to defining equal access as a facility which enables customers to access an operator of their choice without dialling additional digits (compared to accessing BT or other operators). Broader issues, which might be considered as part of a wider definition of equal access, have not been included in this study[46].

On this basis, the benefits of equal access exceed the costs only if:

1. pre-selection with a call-by-call over-ride is mandated;

2. the impact of this on the rate of migration to new long distance operators and/or the threshold discount required by customers to move to an alternative long distance operator is significantly greater than we believe is likely to be the case.

Therefore, there is no conclusive evidence that, in the UK at this present time, equal access (as defined for the analysis) has benefits that exceed its costs.

[46] These broader issues may include access to network and periphery facilities: do other operators have access to:
- unbundled points of BT's network (e.g. local loop);
- signalling used by BT services;
- IN (intelligent network) functions used by BT services;
- databases used by BT services.

APPENDIX A: TERMS OF REFERENCE

CONSULTATION STUDY ON EQUAL ACCESS: TERMS OF REFERENCE

Introduction

1. This paper sets out the terms of reference for a cost benefit analysis to examine the case for the introduction of equal access to the UK telecoms network.

2. Equal access, for the purposes of this study, is the facility for customers to be able to choose the long line operator by which their trunk calls are conveyed, either by means of pre-selection or on a call by call basis. The former may be provided with a facility to override the pre-selected preference for any particular call.

3. The primary focus of the analysis will be the provision of equal access on BT's network. However, the analysis should also consider the provision of equal access by other operators which could become well-established in the local loop within the next few years.

Background

4 In the 1991 White Paper 'Competition and Choice: Telecommunications Policy for the 1990s' the then Director General concluded that equal access should be introduced as soon as possible subject to principles set out in Appendix 3 to the White Paper. A copy of this Appendix is attached at Annex B. The White Paper also concluded that all local operators should be free to offer equal access, but only those that are 'well-established' in the local market should be required to offer it.

5. In November 1993, the Director General issued a consultative document "Cost Benefit Analysis of Equal Access" which set out the proposed approach for a later cost-benefit analysis. A copy of the consultative document is given in Annex A. The response to this document was very mixed and no clear view as to the desirability of equal access emerged.

6. The principle requirements governing the provision of equal access over BT's network are set out in Condition 13A of BT's licence. A copy of this Condition is at Annex C. Condition 13A.2(a) of BT's licence provides that:

> "At any time after 31 December 1992 the Director may, subject to the provisions of paragraph 13A.3, make a direction that whenever an Operator so requests after a date specified in the direction [BT] shall make equal access available in respect of that Operator on the basis set out in this Condition 13A."

And Condition 13A.3 (a) provides that the Director shall not make a direction under Condition 13A.2 unless:

> "(a) he has carried out a cost-benefit analysis comparing

the likely benefits to telecommunications customers to be gained from the introduction of equal access with all costs likely to be incurred, including opportunity costs, which analysis indicates that the gains outweigh the likely costs".

Similar provisions exists in other public telecommunications operators' licences.

Objectives

7. The primary objective of the cost-benefit analysis is to establish whether the introduction of equal access would satisfy the requirements of Condition 13A.3 (a) of BT's licence. The study should indicate what conditions are necessary for the gains to outweigh the likely costs.

8. The study should undertake separate analysis of the two forms of equal access described above (pre-selection and call-by-call). However, condition 13A.5 of BT's licence requires that BT provide the customer with a choice of either option, and an overall analysis will therefore need to aggregate the costs and benefits of providing both.

9. For each option, the study should consider what other factors might be desirable or might increase the benefits offered by equal access. For example, in the case of pre-selected equal access, the study should consider whether customers might be balloted and what the costs of this would be. (It should be remembered, however, that the White Paper makes clear that no customer is to be forced to choose equal access and that they may remain with BT by default). The study will also need to take account of the possibility that the rate at which BT is allowed to rebalance its prices may change within the timescale addressed by the study, and will need to indicate the sensitivity of costs and benefits to the speed with which BT is allowed to rebalance.

10. The study will also be required:

- to indicate how the benefits of equal access would arise and how they would be distributed among various groups of customers and operators;

- to consider what other access arrangements might be available to those customers who are not expected to have access to cable operators or other local competition. This should cover the extent to which local loop operators will offer customers choice in the long-distance market by negotiating with competing long-distance operators and the number and type of customers who will have no alternative local loop provider, bearing in mind the likely roll-out of cable networks, developments in radio-based provision and any other forms of local competition. Technical developments, such as the possibility of selecting a least-cost routing service, should also

be taken into account;

- to show where the costs of providing equal access will fall and how they should be allocated among the first and subsequent operators, taking into account the effect which this might have on competition and new entry, and within the framework for cost-allocation set out in Condition 13A.10 of BT's licence;

- to consider the implications which either main option will have for the development of competition and the entry of new operators, in long-distance and international services and in the local loop. Local loop operators have argued that existing competition there could be threatened by equal access and that this could offset any benefits from increased long-distance competition;

- to consider the implications of experience in other countries and in Hull for the likely effects of equal access on competition. This may also be relevant for estimating costs, for service quality, for the question of balloting and the relative merits of the two forms of equal access. However, differences in industry structure need to be borne in mind since local loop competition is typically absent;

- to provide an indication of the level of service quality (eg call set-up delay, transmission performance and call failure rates) expected by each of the options evaluated, insofar as such considerations are not included in the cost-benefit analyses and initial work shows the probability of a material difference;

- to consider where interconnection to the BT network should take place, taking into account the relevant technical requirements and costs;

- to indicate how and over what time period equal access under the options considered could be introduced, showing how the costs and benefits are affected by this. The study will need to estimate how quickly customers' behaviour will change as a result of the introduction of equal access, and hence the likely timescale in which benefits will become apparent. On the basis of this analysis, the study should show the costs and benefits on an appropriate medium and longer term basis (for instance over 5 and 10 years);

- It may be that over this sort of timescale the requirement to provide equal access will only apply to BT because other operators will not become 'well-established' in the local loop within the normal meaning of this term (ie having 25% or more of the

total voice telephony market in that area). Nevertheless, the analysis should examine the costs and benefits of extending the requirement to provide equal access to other operators if they were to become well-established.

The Analysis

11. The earlier consultation document sets out a framework for the conduct of a cost-benefit analysis of equal access. It provides a general analysis which should be taken into account in the appraisal for which tenders are now being invited, but is not the cost-benefit analysis itself. It does, however, outline the main ways in which the benefits and costs of equal access are likely to arise.

12. As with any cost-benefit analysis, a baseline must be specified against which to judge the effects of equal access. The appropriate baseline is "partial equal access" (also known as "easy access") which BT is required to offer under the terms of its licence. Easy access allows a BT customer to select an alternative trunk operator by dialling a short code prefix. If no prefix is dialled, BT carries the call.

13. The base case must take account of likely developments in BT's price control and in the Access Deficit Charging (ADC) regime. BT's licence states (Condition 13A.5 (a) (i)) that: equal access will not attract ADC waivers while easy access is eligible for waivers. As the ADC position is due to be reviewed in 1997, the analysis should examine three scenarios:

- the situation up to 1997, with ADCs payable at the current rate on Equal Access, but waivers available for easy access;

- ADCs no longer payable on Equal Access traffic after 1997 (ie BT allowed to fully rebalance its prices after this time);

- ADCs payable on both Equal Access and easy access without waiver post-1997.

14. The base case must also reflect the likely development of competition in local, long-distance and international markets in the absence of equal access, including the completion of the cable companies' build obligations and the possibility that a small number of radio-based licensees might come to market. It will also be necessary to consider whether the distinction between the local and long-distance markets, which underlies easy access, will disappear as conveyance costs fall and tariffs become more cost-based, and to take account of developments such as number portability.

APPENDIX B: LIST OF COMPANIES AND ORGANISATIONS INTERVIEWED

Meetings and interviews were held to ascertain the views of the following organisations on the costs and benefits of equal access:

- AT&T;
- British Telecom (BT);
- Cable Communications Association (CCA);
- Energis;
- Eurobell;
- Ionica;
- Kingston Communications;
- Mercury;
- Sprint;
- Telecommunications Industry Association (TIA).

Written views were supplied to us by the Telecommunications Managers Association (TMA).

In addition, information was supplied to us by the following switch manufacturers:

- GPT;
- Northern Telecom;
- Ericsson.

APPENDIX C: POTENTIAL BENEFITS OF COMPETITION

1. Introduction

This Appendix examines the empirical evidence regarding the potential benefits from increased competition and provides some justification for the estimates of 'Type 2' benefits used in our cost benefit analysis.

The potential benefits of increased competition include:

improved cost efficiency as a result of increased competitive pressure;
lower prices as a result of improved efficiency or lower profit margins;
increased technical and commercial innovation stimulated by a more competitive market;
the long term impact of having competition that is driven by market forces rather than by regulation;
the value to consumers of having a greater degree of choice.

It is difficult to quantify the impact of the last three types of benefit and we have therefore concentrated on the benefits of improved cost efficiency and lower prices. This means that our estimates of Type 2 benefits may be conservative, although some of the technical and other excluded benefits of increased competition may feed through eventually into efficiency improvements and/or price reductions and thus be picked up in the figures that we derive.

In Sections 2 and 3, we report the main findings from a survey of the economic literature on the benefits of competition, considering first efficiency improvements and then price reductions. Section 4 presents our conclusions.

2. Efficiency Gains

The literature identifies two broad types of inefficiency which can raise costs in the absence of competition:

inefficient production can result from a general inefficient use of resources (i.e. "slack"). Alternatively, it may be caused by managers using the wrong mix of inputs, for example production may be too capital intensive (this a serious risk under rate of return regulation) or too labour intensive (perhaps because labour is able to influence the method of production);

non-market factor prices can also lead to inefficiency, for example the supply price of labour may be too high if the labour force is able to secure wage agreements above the market rate and hence share in monopoly "rents".

In many cases, the literature provides anecdotal evidence to support the potential benefits of competition, but there are relatively few attempts to separate the impact of increased

competition from, say, the effects of privatisation and changes in regulation. Those that have been made, and relate to or include telecommunications, are summarised in Section 2.1 below.

2.1 *Studies Relating to Telecommunications*

A recent Bell Canada study (Staranczak et al (1994)) looked at the productivity performance of either sole or dominant telecommunications providers in 10 industrialised countries including the UK during 1984-87. Using regression analysis, the study concluded that "private ownership increases productivity growth, while there is no evidence that the existence of facilities-based competition does". However, as the authors point out, although the regression analysis "did not indicate any positive relationship between competition and productivity growth over the sample range, an analysis over a longer time period with an improved specification for technological change could". Moreover, the period 1984-87, which is used in the Bell Canada analysis is, for most of the countries in the study, characterised by only very limited competition in the telecommunications industry. In the UK, for example, Mercury did not begin offering a PSTN service until 1986.

Haskel and Szymanski (1993a) attempted to quantify the separate impact on productivity of changes in competition, ownership, management and regulation. They used data for the period 1972/3 to 1988/9 for 12 UK firms (including BT) which were publicly owned in 1972 but have since been privatised or restructured. Considering the impact of increased competition, they concluded that

> "Increases in competition significantly increase productivity. This supports the view that increased competition in both public and private industries can raise efficiency."

Specifically Haskel and Szymanski found that, on average, each 1% fall in the firm's market share[47] leads to a one off productivity improvement of 0.47%.

In a companion study covering a similar panel of firms (Haskel and Szymanski (1993b)), the same authors found that a 1% loss in market share led to a 0.76% reduction in wages.

Two studies of the US telephone industry found evidence of significant efficiency gains resulting from competition and the divestiture of AT&T:

- Oum and Zhang (1991) found that, by 1987, total factor productivity for the local exchange, carriers (LECs) and AT&T had grown by an additional 11-17% compared with overall market share loss of less than 10%;

[47] When measuring market share, Haskel & Szymanski adopted relatively wide market definitions. For example, British Rail's market share was calculated on the basis of total passenger kms on buses, coaches, road, rail and air.

- Ying and Shin (1991) found that the divestiture of AT&T and the subsequent increase in competitive pressure led to efficiency gains of 3-5% of the LECs' total costs between 1984 and 1987. NERA estimates that LECs' loss of market share over this period was 3% at the most.

The respective contributions of divestiture and competition are not know, but it seems safe to conclude that some part of the above increases is attributable to the impact of competition.

Two Japanese studies found that significant total factor productivity improvements in the telecommunications industry resulted from deregulation:

- Oniki et al (1993) found that liberalisation and privatisation together led to an increase in NTT's total factor productivity of 1.3% a year between 1982 and 1987. This compares with a loss of market share which only amounted to 3% in 1989;

- Imai (1994) found that an additional 15% increase in KDD's total factor productivity over the period 1985-1992 (ie following liberalisation) was associated with a 29% loss of market share. KDD's experience is interesting because there was no change in ownership (it was already privatised) and no divestiture (it was already separate from NTT). It is therefore reasonable to conclude that most of the additional increase in productivity stemmed from the introduction of competition.[48]

2.2 *Other Studies*

There is evidence to suggest that small reductions in the share of the largest companies (concentration ratios) can have a impact even in already competitive markets. Haskel (1991) examined the impact of changes in product market conditions on labour productivity in 81 manufacturing industries with average five firm concentration ratios of between 33% and 42% (depending on the measure used and the year). He found that the coefficient for (5 firm) market concentration was significant and ranged from -0.01 to -0.04, with the latter estimate being derived from the best fit specification. Nickel (1993) looked at the impact of competition on the productivity performance of companies. Using samples of up to 761 manufacturing companies in the United Kingdom between 1975 and 1986, Nickel found that the results of his analysis provide "some support for the general thesis [of] a positive effect of competition on both levels and growth rates of total factor productivity at the firm level."

Moreover, these studies consider only labour or total factor productivity gains. To the extent that competition may lead to improvements in the range and quality of goods or services supplied, such studies may understate the true gains from increased competition.

[48] As regards Ministry regulation of prices, Imai notes that "the general principle remained the same after the 1985 deregulation" with tariffs required to be fair and reasonable in relation to costs, to promote efficient utilisation of facilities and to be non-discriminatory.

Other studies contain mainly qualitative or anecdotal (i.e. industry and time specific) evidence to support the view that increased competition may lead to substantial efficiency gains. For example, Cubbin, Domberger and Meadowcroft (1987) found that the introduction of competition into the tendering process for refuse collections in the UK led to a rationalisation of rounds and rosters which increased both labour and vehicle productivity. Overall, there was a 20% decrease in refuse collection costs following the introduction of competitive tendering.

Bishop and Thompson (1992) assessed the productivity performance over the last 20 years of the nine largest nationalised industries (as they were in the early 1980s). The article considered that "productivity growth has increased during the 1980s relative to the growth rates observed during the 1970s". They assess in broad terms the extent to which productivity changes were the result of efficiency improvements rather than scale effects and technical progress, but do not try to distinguish between the effects resulting from competition and those from changes in the control regime (privatisation and regulation).

Many studies have examined the impact of liberalisation in the US airline industry. Following the Airlines Deregulation Act of 1978, routes were fully deregulated by 31 December 1981, and rates were deregulated by 31 January 1983. Following deregulation, a number of new operators entered the market, and some of the smaller firms already active in the market expanded their operations. As a result, the market share of the eight largest companies fell from 81% in 1978 to 70% in 1985, while the share of the largest four fell from 57% to 51% over the same period.[49] Findings on the impact of deregulation include the following:

- there were significant productivity improvements - employee productivity of established airlines rose by 3.7% a year between 1979 and 1984 (Kaplan (1985)), while average load factors in 1983 were 10-20% higher than in 1973 (Bailey (1986));

after taking account of the impact of new equipment, costs fell by 1.5% a year between 1978 and 1984 despite a slowdown in traffic and capacity growth, compared with 1.2% a year between 1970 and 1978 (Sawers (1987));

incumbent carriers have instituted two tier wage contracts in order to reduce labour costs, with new workers being paid less than workers who are still covered by the old wage agreement (Bailey (1986));

there have been significant improvements in network design, through the development of a hub and spoke network. This was found to be the most important reason for the real fare reductions which followed deregulation (Bailey *et al* (1985)).

[49] Source: Sawers (1987). After 1985, the market shares of the largest operators then rose as a result of widespread mergers.

3. Price Changes

There are several reasons why increased competition may lead to lower prices, including efficiency gains which are passed on to consumers, or the erosion of monopoly power and profits. Alternatively, prices may change as a result of more general price rebalancing, often to remove cross-subsidies which cannot be sustained in a more competitive environment. In this section, we report findings from studies of the impact of deregulation on price levels in the US financial services, airline, and road and rail freight industries.

US Stock Brokerage

Bailey (1986), considering the impact of the abolition of fixed rate stock brokerage commissions in 1975, found that commission rates paid by institutional investors fell by about 11% a year between 1975 and 1981, while the rates charged to individual investors fell by about 4% a year. While some of the fall in prices can be attributed to an increased volume of trading (i.e. economies of scale), the differential impact on institutional and individual investors reflects the removal of previous cross-subsidies, and there is no doubt that competition has had a beneficial impact. Bailey concluded that

> "The fall in rates for most classes of clients, individuals as well as institutions, has stemmed, at least in part from open entry under which large rents no longer have to be paid for seats on the exchange."

During this time, both the number of brokers and the range of services on offer have increased significantly, and there have been technological improvements in trading systems. Nevertheless, the driving force behind these changes has been the introduction of competition, which has provided increased incentives for entry and for a rebalancing of commission rates (since institutional investors previously cross-subsidised small private investors).

US Airlines

Kahn (1988) reports that air fares have fallen by an average 3% a year between 1976 and 1988. Majone (1990) has estimated that real reductions in airline fares since 1973 have resulted in consumer benefits of $4.7 billion a year by 1985 (compared to if fares had remained constant in real terms). Including the benefits from increased travel which results from lower fares, the benefits rise to $9.7 billion a year.

In addition to these price changes (which are partly explained by the efficiency improvements described in Section 2), consumers have benefitted from an increased diversity of choice. Thus smaller local service carriers increased their share of domestic revenue passenger miles from 12% to nearly 30% between 1978 and 1982 (Kaplan (1978)).

US Freight Delivery

Road freight rates were deregulated in 1975 and rail freight rates were deregulated in 1979. In the case of road freight, Moore (1985) found that "truck load" (TL) rates fell 4% a year between 1975 and 1982, while "less than truck load" (LTL) rates by 2% a year.[50] Similarly, rail transport rates fell by 2.7% a year between 1979 and 1982.

The deregulation of rail freight rates also influenced road freight rates. Thus Moore found evidence to suggest that the relative cost advantages of different methods of transport have begun to influence the pattern of demand.

4. Conclusions

From the various findings outlined above, it is clear that increased competition often has a significant and beneficial impact on both costs and prices. Although such benefits are unlikely to be confined to specific industries or countries, many of the studies have considered industries which share common features with UK telecommunications, including pricing restrictions, restricted entry and use of a network structure.

Importantly, many of the studies have considered industries where there was already some competition, and have looked at the benefits of competition over a number years. This suggests that further increases in competition will continue to yield significant benefits, even in industries where competition is extensive and well established.

Table C1 summarises the quantitative findings of the studies, which consider a wide range of industries and employ a number of different methodologies. This confirms that deregulation and increased competition can bring substantial benefits to consumers.

[50] Bailey (1986) explains the disparity between TL and LTL rates as the result of increased entry in the TL business relative to the LTL business.

Table C1
Summary of Estimated Benefits of Competition

Industry	Real Price Decrease	Productivity Change	Change in Factor Prices
10 industrialised countries (telecoms)		No statistically significant effect	
Japan (international telecommunications)	15%+	additional 15% improvement in total factor productivity associated with 29% loss of market share	
US telecoms (long distance and local)		additional 11-17% improvement and 10% market share loss*	
US telecoms (local)		additional 3-5% improvement associated with 3% market loss*	
UK privatised utilities			0.76% reduction in wages per 1% fall in dominant firm's market share
UK privatised utilities		0.47% increase per 1% fall in firm's market share	
UK manufacturing industries		0.12% increase in market leader productivity per 1% change in the 5 firm concentration ratio	
US Stock Brokerage	4-12%		
US Airlines	3% pa	3.7% pa (employee productivity)	
US Road Freight	2-4%		
US Rail Freight	2.3% pa		
UK Refuse Collection		20%	

* *Some part of these gains is likely to be attributable to the organisational impact of divestiture.*

Note: See text for a more detailed explanation of sources and findings

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